
Pesticides Basics

Substances that kill pests and other living things

Module Objective:

Trainees know and explain pesticide basics



Module Overview

- How pesticides fit into the project life cycle
- Brief evolution of pesticides, with issues
- Pesticide contents, labels, & formulation
- Older heavy metal & synthetic pesticides
- Problems with heavy metals & synthetics
- Pesticides from plants, microbes & insects
- Pesticide fate, resistance, impacts on humans and environment, groundwater



Why is this important to you?

- **RFP:** Write requirements for *understanding* pesticide types, formulation, resistance, & safety for each crop/animal production system
- **Proposals:** See *evidence* of understanding of pesticide types, formulation, environmental issues, resistance & safety management
- **Environmental Assessments:** Request that an IEE/PERSUAP is budgeted & undertaken by project, *and be able to critique it*



Why is this important to you?

- **Monitoring:** In the field, be able to ask questions about risks and understand pesticide products
- **Markets:** Ensure project links to GAP- or Organic-certifiable market demand



The Very First Pesticides

Inorganic metals

4500 years ago

- Elemental Sulfur— still used today
- Sodium Chloride (salt) weed killer— can still be used

600 years ago

- Mercury
- Lead
- Arsenic

200 years ago

- Arsenates (copper, lead, calcium, magnesium)



1800s Rotary Hand Dusters:

Has the technology improved since then?



Late 1800s - Early 1900s Pesticides

Plant Extracts

- Pyrethrum — still used today
- Neem — still used today
- Rotenone — still used today
- Nicotine-Sulfur compounds
- Citronella — still used today

Petroleum products

- Oils, Soaps — still used today
- Kerosene — still used today

Gasses

- Cyanide — gone
- Methyl Bromide — phasing out



Synthetic Organic Pesticide Development

- **When?** 1939 with DDT, followed by other “chlorinated hydrocarbons”
- **Why?** To kill malaria & yellow fever mosquitoes during World War II
- **What?** Pests controlled



FIGURE 57.—Refilling knapsack sprayers with oil, 8th Malaria Control Unit, New Guinea.



Problems: *Unexpected things began to happen*

- Need more & more pesticide to kill pests—what happened?
- American Eagle populations declined rapidly—what happened?
- Blood samples from Eskimos in Arctic showed DDT contamination—what happened?



A pesticide is a combination of:

- Active Ingredient (AI), which kills the pest
- A surfactant which makes the pesticide stick to the pest or plant
- Sometimes a synergist which enhances the pesticide's action
- A carrier (like water, oil, or a solvent)



- Concentration of *active ingredient* (20% versus 95%)
- Formulation of the product (what it is mixed with—carriers, activators, surfactants, stabilizers)
- Formulation type



Some common pesticide formulations

- A = aerosol
- B = bait
- D = dust
- EC = emulsifiable concentrate
- F = flowable
- G = granules
- ULV = Ultra Low Volume
- WDG = wettable dispersible granule
- WP = wettable powder



Photo from Pesticide Shop



Most common types of pesticides

About 900 active ingredients in 20,700 products currently sold in world markets

- **Insecticides:** kill insects
- **Fungicides:** kill fungi
- **Herbicides:** kill weeds



Less common types of pesticides

- **Rodenticides:** kill rodents (mice, rats)
- **Microbiocides:** kill microbes
- **Nematicides:** kill nematodes



1920s Application: Has the technology improved since then?



G-2



Older types of synthetic insecticides

- **Chlorinated hydrocarbon** (DDT, Aldrin, Dieldren) 1940s
- **Organophosphates** (Chlorpyrifos, Diazinon) 1950s
- **Carbamates** (Carbaryl, Bendiocarb, Propoxur)



Newer types of insecticides modeled after plant extracts

- **Plant extracted pyrethrum** (mix of pyrethrins) revived from the 1800s
- **Synthetic pyrethroids** (cypermethrin, deltamethrin, lambda-cyhalothrin)
- **Chloro-nicotinyl** (imidacloprid, thiacloprid)



Next generation insecticides

- **Microbes** (bacteria, fungi, virus)
- **Microbial extracts** (BT, abamectin, sphinosad)
- **Insect Growth Regulators—IGRs** (hexythiazox, methoprene)

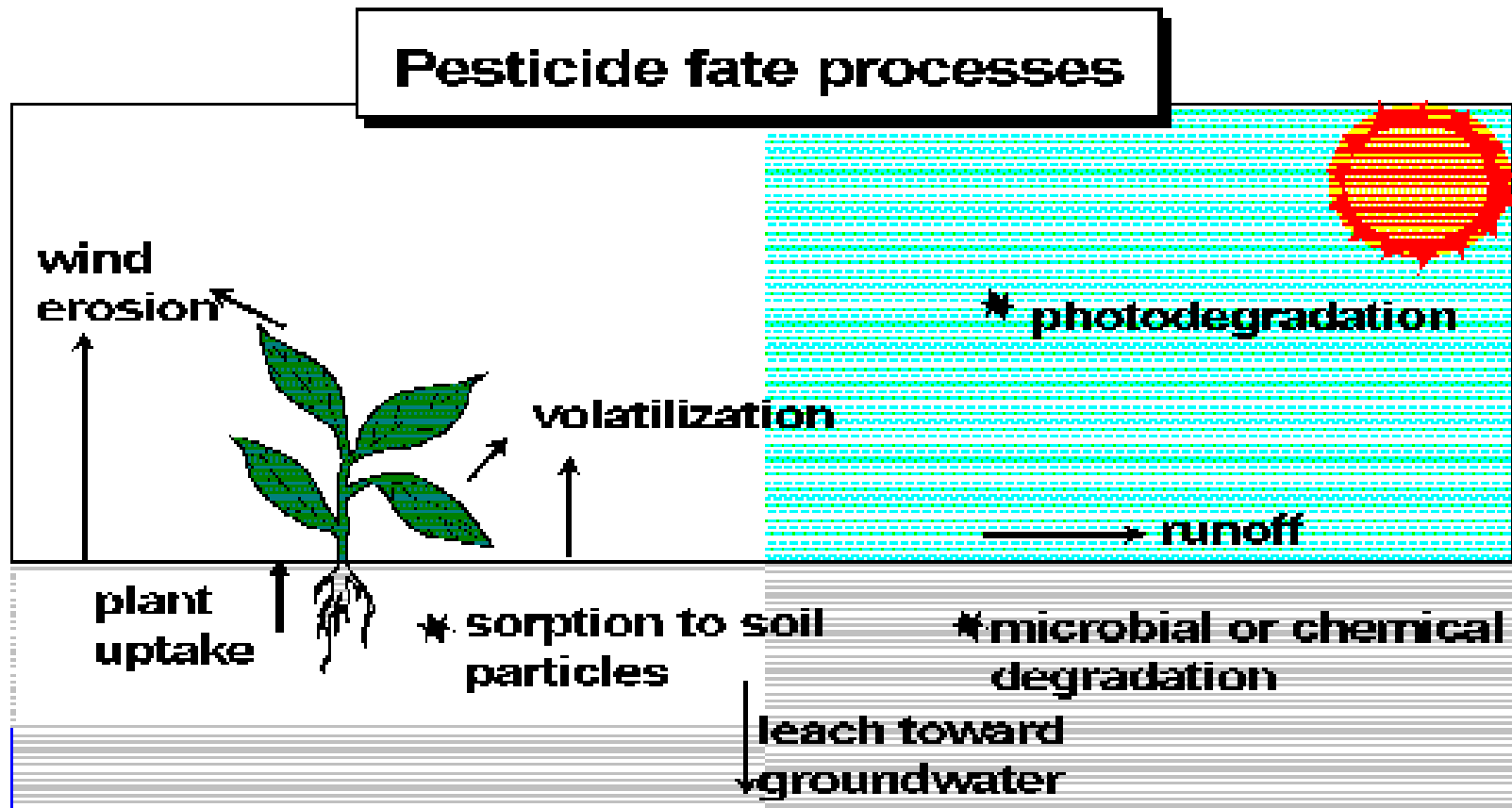


Pesticide Impact on Humans

- **Acute Toxicity:** Some immediately (acutely) toxic to people by poisoning the nervous system leading to death—remember the 5 Pakistanis
- **Chronic Toxicity:** Some can be harmful over time by chronic effects on human health like Cancer, Parkinson's Disease, Sterility, Organ Malfunction and Birth Defects
- Some can enter **groundwater** (drinking water)



Pesticide Breakdown in Environment



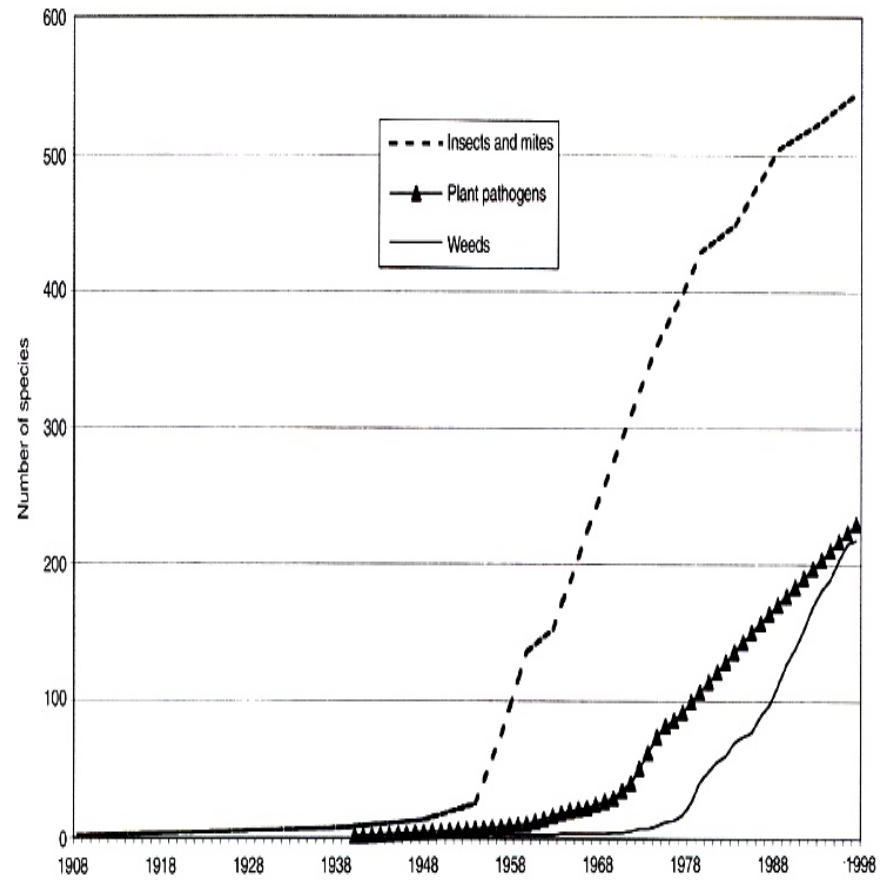
Pesticide Impact on Environment

- In the field, some kill **honeybees** & birds
- In water, **some kill fish**, crabs, frogs, salamanders, aquatic insects & beneficial microbes



Other undesirable pesticide impacts

- Over-application may cause pests to develop **resistance** to a pesticide or class of pesticides
- May kill **endangered species** or animals in National Parks or protected areas



Number of pesticide-resistant species, 1908 to 1998.



Wrap Up: What you need to know

- Environmental & resistance risks
- Pesticide breakdown in the environment
- Acute & chronic health impacts on people
- Most common types of insecticides



And, you should know about

- Next generation pesticides
- Positive evolution in safety since 1800s
- Many plant extracts that are not new, but still very useful (especially for Organic)
- Pesticide formulations & labels



You should be able to:

- Write requirements for *understanding* pesticide types, formulation, resistance, & safety for each crop/animal production system into **RFP**
- Recognize understanding of pesticide types, formulation, environmental issues, resistance & safety management in the **Proposal**
- Critique an IEE/PERSUAP for all of these issues



And, you should be able to:

- **Confidently Monitor** projects in the field, and be able to ask questions about risks and understand pesticide products



Group Exercise

- Complete the short quiz on insecticide types & issues to be aware of
- Discuss results with team
- Discuss team findings with others

